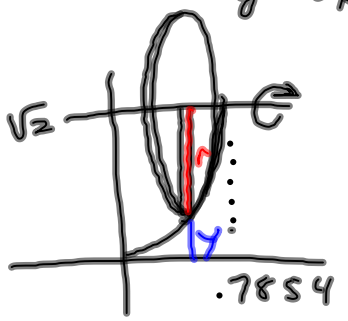
21. $y = \sqrt{2}$; $y = \sec x \tan x$ about $y = \sqrt{2}$

y-axis

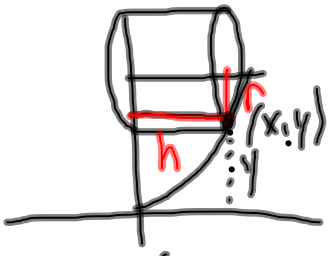


$$\int_0^{.7854} \pi \left(\sqrt{2} - \sec x \tan x\right)^2 dx$$

$y + r = \sqrt{2}$

$r = \sqrt{2} - y$

$r = \sqrt{2} - \sec x \tan x$



$r = \sqrt{2} - y$

$\int 2\pi r h \, dy$

$h = x$ - hard to get in terms of y

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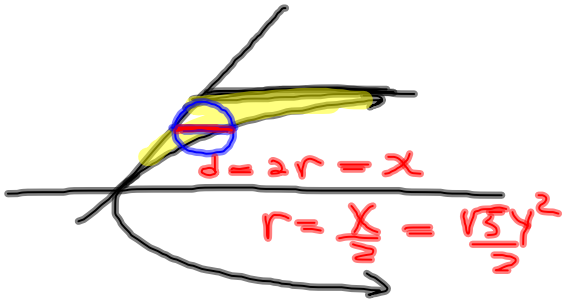
41. $y = 0$ $y = 2$ circular disks y-axis → parabola

$x = \sqrt{5} y^2$



$$\int_0^2 \pi r^2 \, dy$$

need r in terms of y

$$8\pi = \int_0^2 \pi \left(\frac{\sqrt{5} y^2}{2}\right)^2 dy$$

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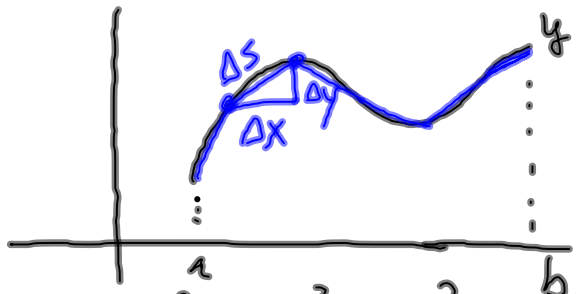
7.4 arc lengths (length of a curve)



s = arc length

$$s = \int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$

$$\Delta s_i^2 = \Delta x^2 + \Delta y_i^2$$

$$\Delta s_i = \sqrt{\Delta x^2 + \Delta y_i^2}$$

sum

$$\lim_{\Delta x \to \infty} \sum \sqrt{\Delta x^2 + \Delta y_i^2} = \lim_{\Delta x \to 0} \sum \sqrt{1 + \left(\frac{\Delta y}{\Delta x}\right)^2}\, \Delta x$$

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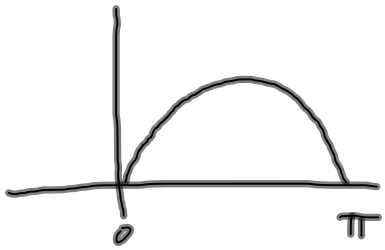
$y = \sin x \quad [0, \pi]$



– length of this arc $= \int_0^{\pi} \sqrt{1 + (\cos(x))^2}\, dx$

$\frac{dy}{dx} = \cos x$

$= 3.8202$

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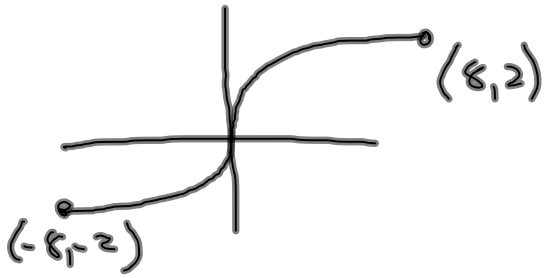
$y = x^{\frac{1}{3}}$ $[-8, 8]$



$\frac{dy}{dx} = \frac{1}{3}x^{-\frac{2}{3}}$

undefined at $x = 0$

get $x = g(y)$

$$\int_c^d \sqrt{1 + \left(\frac{dx}{dy}\right)^2}\, dy$$

$x = y^3$ $\frac{dx}{dy} = 3y^2$

$$\int_{-2}^{2} \sqrt{1 + (3y^2)^2}\, dy$$

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